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Grassmann, Hamilton, Dirichlet, and Dedekind. Finally, geometry and trigonometry are taken up. The beginnings of geometry among the Egyptians and Babylonians, its golden age in Greece, its dormancy among the Romans and their successors, its renaissance under Vieta, Kepler, Cavalieri, Roberval, Fermat, and notably under Descartes, its advancement by Pascal and Newton, the foundation of modern geometry by Monge, Carnot, Poncelet, Chasles, Mobius, Plücker, Steiner, and Von Staudt are the towering points of this development. Lastly, non-Euclidean geometry receives consideration.

As will be apparent from the preceding brief *résumé*, the work subserves in an eminently satisfactory manner the requirements of both practice and theory. For the biographical matter, which is common in the usual histories, but here omitted, an appendix of biographical notes alphabetically arranged has been substituted. The book has a thorough index, and it only remains to say that the work of the translators has been conscientiously and skilfully performed. μ.

GESCHICHTE DER PHYSIKALISCHEN EXPERIMENTIERKUNST. By *Dr. E. Gerland* and *Dr. F. Traumüller*. Leipsic: Verlag Wilhelm Engelmann. 1899. Pages, xvi, 442. Price, 14 marks.

For real intrinsic fascination, the history of the art of physical experimenting far surpasses that of the development of physical ideas; it is palpable and concrete, and so indissolubly connected with the history of the industrial arts and of material civilisation as to command the interest even of sociologists and of practical men, while certain theatrical features are not lacking to it that will compel the attention of even the general reading public. The present work by Dr. E. Gerland, professor in the Royal Mining Academy of Klausthal, and Dr. F. Traumüller, of the Nikolaigymnasium of Leipsic, both of whom are known for their labors in the history of science, will be found to subserve in an admirable manner the requirements which so extensive and important a task impose. It describes the ways by which physics has reached its present perfection, and portrays the mechanism and mode of operation of the instruments which have promoted its progress. The book is filled with reproductions of apparatus from the original editions of the great physicists, and with drawings of famous apparatus that have been preserved. Where possible, the descriptions also have been taken from the original works. In this manner, the authors believe that they have brought to light much that was unknown or forgotten. The history of the art of physical experimentation in antiquity, beginning with the Babylonians and Assyrians and ending with the Romans and the later Alexandrians, is passed in review, and many curious and ingenious instruments described, of the existence of which few people have the slightest idea. The Eastern Greeks and the Arabs then receive due notice, and the Middle Ages, the Renaissance, and the sixteenth century, which brought forth the works of Porta Gilbert, Leonardo da Vinci, and Stevinus, are afterwards considered. The period of Galileo, Kepler, Huygens, Newton, and Leibnitz, which overshadowed all the centuries that preceded and even that which followed, receives of course the lion's share of the authors' attention, and offers most that is important and stimulating. Here modern science is embryonic and here its genius took its greatest leaps. The experimental art of the seventeenth century and the first part of the eighteenth found its Justinian in the celebrated Dutch physicist, 's Gravesande, from whose works a great number of the descriptions and illustrations of physical instruments have been taken. The apparatus of the present modern period have been embodied in the work only in a slight degree and in so far as they have been determinative. This is especially true in the department of electricity. Whatever may be regarded as ephemeral or can be found in the text-books has been omitted. Considerable credit is due to the publishers on the score of the illustrations, which are very numerous, and which must have been collected at considerable expense. *μκρκ.*

THE ELEMENTS OF PHYSICS. For Use in High Schools. By *Henry Crew*, Ph. D., Professor of Physics in Northwestern University. New York: The Macmillan Co. 1899. Pages, xiii., 347. Price, $1.10.

There are several notable points to be remarked in Professor Crew's new elementary text-book of physics. He has endeavored to treat his material not as a series of disconnected subjects in which mechanics, sound, light, heat, and electricity occupy isolated places (a division which is based rather upon the geography of the body than on reason), but as a body of *organised and rational truth forming a single great whole.* He has also injected rigor into his book without sacrificing naturalness,—qualities which most text-book writers in their wild endeavor after artificial simplicity seem to miss altogether.

We learn immediately from Professor Crew's opening definition that his view of physical science is that of the so-called mechanical philosophy, according to which the phenomena of nature are reducible to motion. In accordance with this principle the subject of motion is first considered. Elementary vector analysis is introduced from the start, and the consideration of directed quantities is carried in a very satisfactory and fruitful manner throughout the entire work. This in itself is a decided gain. We have in the second chapter a discussion of simple harmonic motion; in the third, a discussion of the general properties of matter, inertia, mass, force, work, energy, gravitation, elasticity, which are lucidly and concisely treated; in the fourth, a treatment of the special properties of matter, where the properties of liquids and gases are treated; in the fifth, a very clear and pregnant discussion of the theory of wave-motion which is made the foundation of the best part of the chapters on sound, heat, magnetism, and light that follow. The author has throughout endeavored to appeal to the existing stock of experience of his pupils, which he believes offers an adequate foundation for a rational superstructure of physical knowledge, and he has also aimed to make his treatment the treatment of naturally developing thought. The fundamental conceptions are rigorously and concisely defined, and form in this respect a sharp contrast to the logical looseness